ELS CAPACITY CONTROL SYSTEM FOR AXIAL-PISTON PUMPS

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Axial-piston pumps are good sources of capacity for hydro drives of vehicles, aerospace device etc. This fact related to its little mass and compact outer dimension along with high capacity. There are a lot of modern scientific publications about different aspects of axial-piston pumps development [1-3 et al.]. One of the most perspective direction of researches in this field is establishing electronic load sensing (ELS) systems for pressure and flow (capacity) control of axial-piston pumps with swash plate.

An analysis of catalogues world-wide leading manufacturers of electrohydraulic drives and its components, such as Parker Hannifin, Bosch Rexroth, Moog, Atos, Danfoss et al., was performed. The analysis has shown that the most advanced scheme of capacity control of axial-piston pump with swash plate is scheme based on electronic pressure sensor and magnetostrictive sensor of displacement of swash plate. But the scheme has got some downsides:

1. the control system based on deviation equalization always has a static error. It is reason why this system is worse than a control system based on perturbation equalization (invariant control system);
2. the magnetostrictive sensor of displacement and kinematic elements which connect it with a swash plate make system more massive, more difficult and less reliable;
3. the pump flow depends on a rotational speed of pump roller which connected with capacity source, such as an internal-combustion engine. It has got a significant influence on static and dynamic characteristics of hydro drives of vehicles.

The first and second problems can be solved by using perturbation feedback, which contain two electronic pressure sensors. In this way ELS-principle of stabilization pump's flow is implemented. If we want to stabilize only pressure in a hydro system, we will use only one electronic pressure sensor. The third problem can be solved by the using sensor of rotational speed of pump roller and PID-controller. These ideas were implemented in the claim for the invention [4].

The next directions of research are going to be mathematical modeling, experimental studies and practical application of ELS control systems for axial-piston pumps with swash plate.

References:

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